

J1050 U.S. PTO  
10/08/1979  
02/22/02

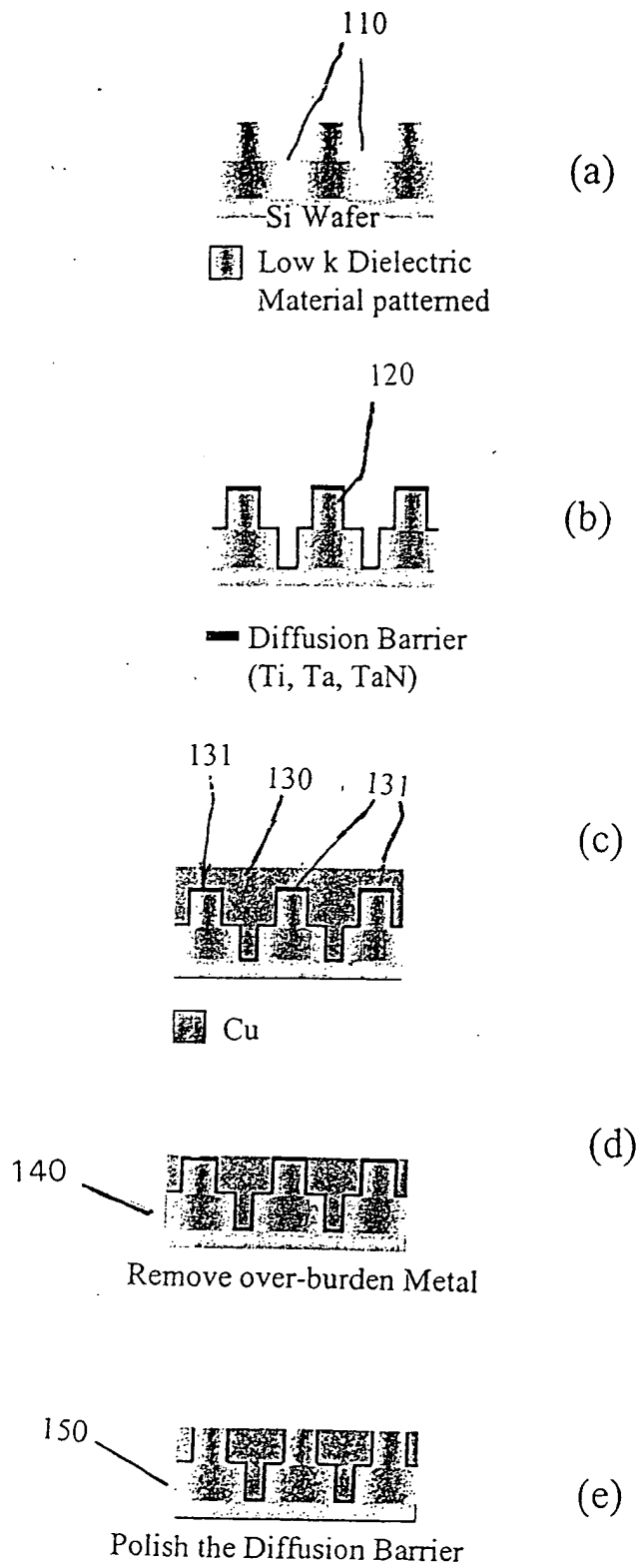


FIG. 1

200

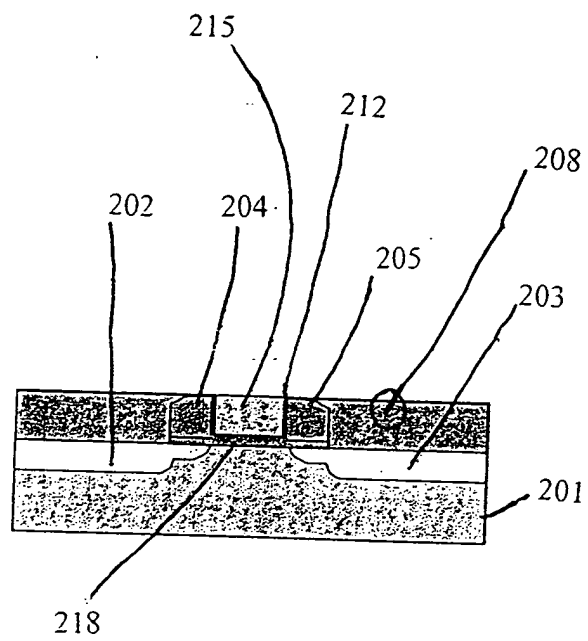


FIG. 2

300

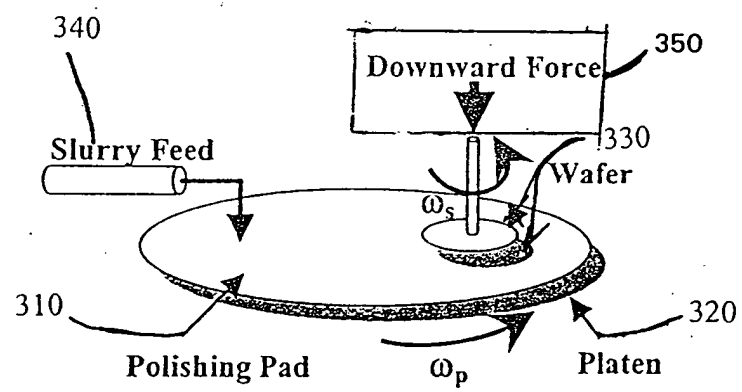


FIG. 3

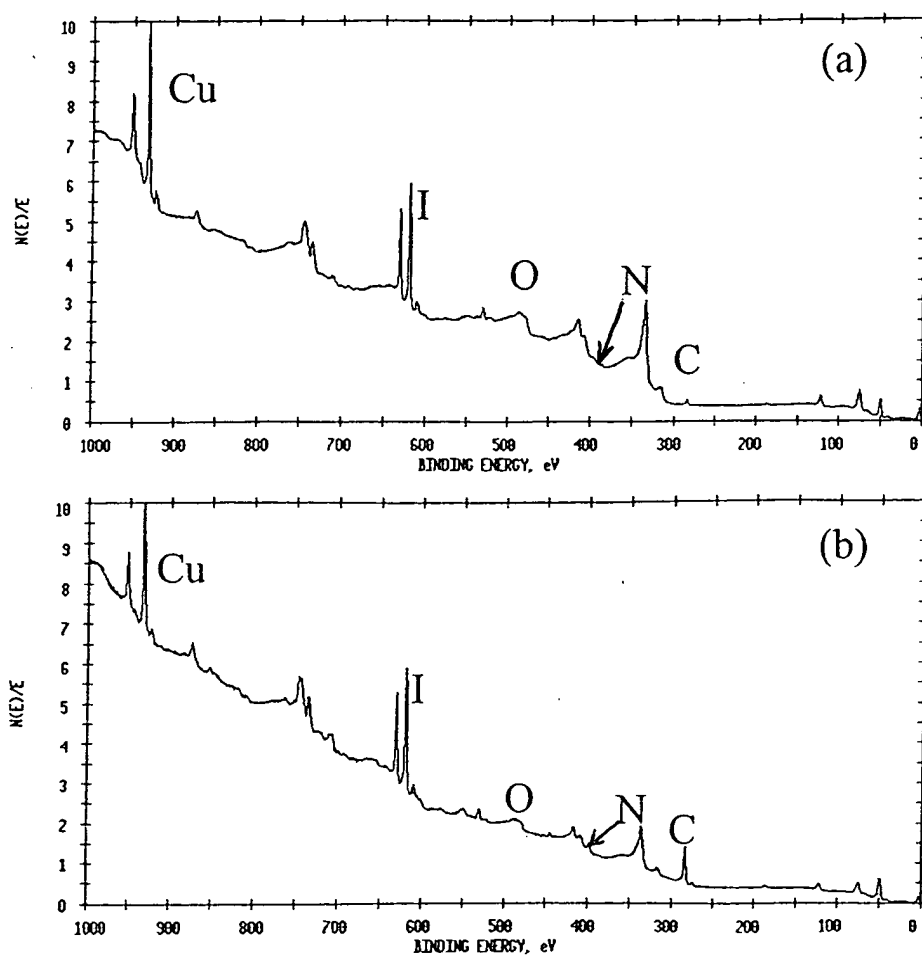


FIG. 4

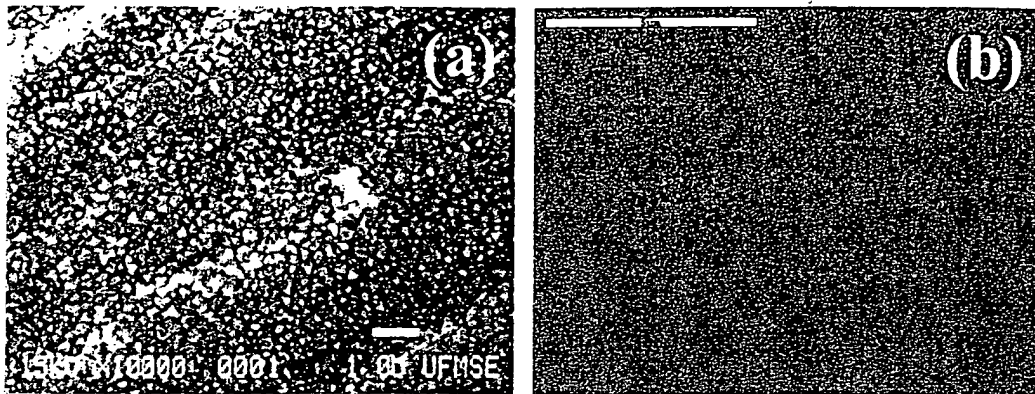


FIG. 5

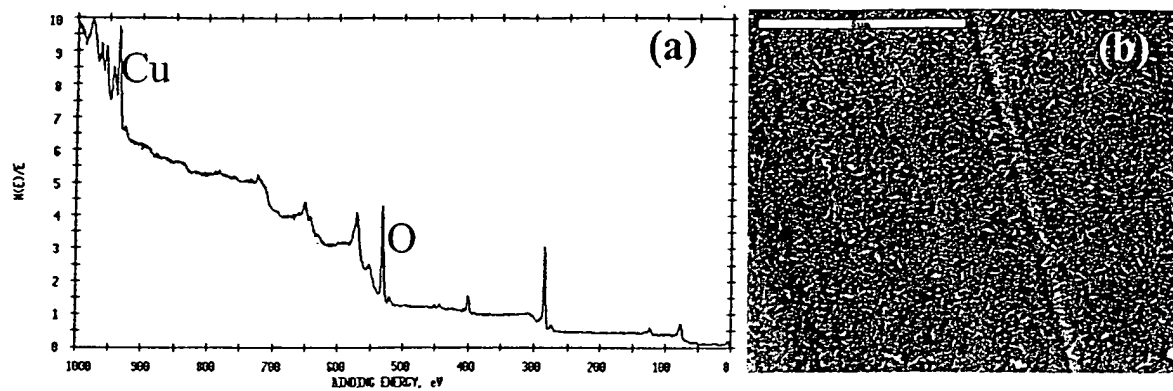


FIG. 6

	Concentration of iodine (N)		
	0.001	0.01	0.1
Removal Rate (nm/min)	53	775.0	2716
Selectivity with Cu/Ta	530	>4500	>5000
RMS (nm)	1.06	1.98	2.13
Scratches #/cm <sup>2</sup>	<5	<5	<5

FIG. 7

	Concentration of Hydrogen Peroxide (%)		
	0.1%	1%	10%
Removal Rate (nm/min)	5	27	6
RMS (nm)	4.2	5.1	-

FIG. 8



Pressure	2.7 psi	4.3 psi	6.7 psi
Removal Rate (nm/min)	298	335	425
Selectivity Cu/Ta	> 3000	> 3000	> 3000
Surface Roughness (nm)	1.06	1.4	2.0
Scratches (#cm <sup>2</sup> )	< 5	< 5	< 5

FIG. 9

	0.01 N iodine				
	pH 4	pH 6	pH 8	pH 10	pH 12
Removal Rate (nm/min)	1210	909	1023	756	23
Selectivity (Ta)	4000	>4000	>4000	>3000	>200

FIG. 10

	Concentration of Particles		
	No particle	1 wt. %	5 wt. %
Removal Rate (nm/min)	71	114	151
Selectivity	> 1000	> 200	> 200

FIG. 11

Effect of small amount of silica in iodine based solution

	Concentration of silica particle			
	No particle	0.01 wt. %	0.1 wt. %	1 wt %
Removal Rate (nm/min)	50.4	80.2	153.6	333.5
Selectivity on Cu/Ta	7200	529	13	8.0
Scratches (#/cm <sup>2</sup> )	0	0	1-2	5

FIG. 12

The effect of inhibitors in iodine solution (pH 4 and 2.7 psi)

	0.01 N I <sub>2</sub>						
	No inhibitor	BTA			TTA		
		1 mM	5 mM	10 mM	1 mM	5 mM	10 mM
Removal Rate (nm/min)	775.0	945.1	56.3	58.4	100.1	106.9	51.8
STD	7.6	14.9	16.6	16.2	27.2	13.2	7.3

The effect of surfactants on removal rate (nm/min) of copper in iodine solution (pH 4 and 6.7 psi)

	10 mN I <sub>2</sub>									
	No inhibitor	SAS					Triton X-100			
		.5 mM	2 mM	5 mM	10mM	20 mM	1 mM	2 mM	3 mM	5 mM
RR (nm/min)	1210.0	1080.9	1040.0	975.7	524.7	514.0	977.5	189.0	129.7	29.5
STD	33.5	55.1	11.6	62.5	34.1	11.5	43.4	30.4	21.2	24.2

The static removal rate (nm/min) of copper in iodine based solutions (pH 4)

		10 mN iodine		
		No additive	5 mM BTA	10 mM SAS
pH	4	64.9 ± 2.65	2.8 ± 0.4	39.6 ± 4.3
	6	63.4 ± 2.37	1.1 ± 0.4	65.2 ± 10.1
	8	48.7 ± 2.4	-1.4 ± 0.7	28.9 ± 0.4
	9	35.2 ± 1.3	-0.3 ± 0.5	27.7 ± 0.4

FIG. 13

	0.01 NI <sub>2</sub> , 10 mM TTA				
	No salt	KI		NH <sub>4</sub> Cl	
		0.001 M	0.01 M	0.01 M	0.1 M
Removal Rate (nm/min)	52	66	92	34	32

FIG. 14

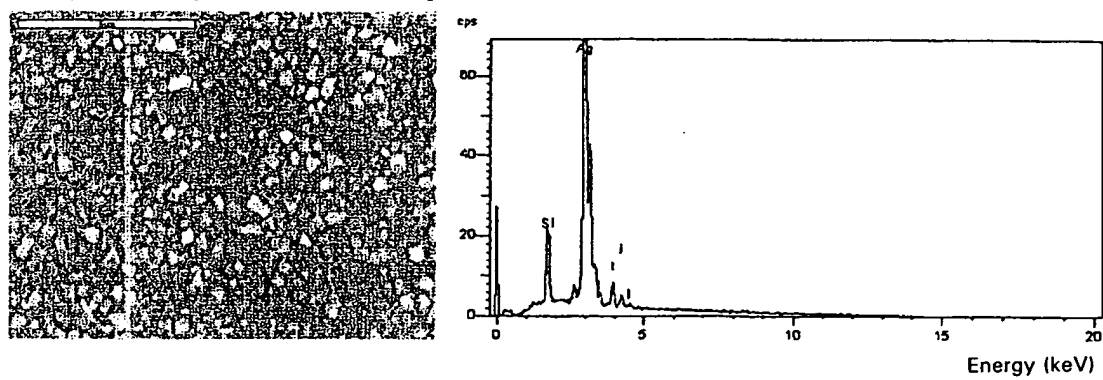
Effect of succinic acid/citric acid added in 10 mM Iodine and 5 mM BTA/TTA on CMP performance

	10 <sup>-2</sup> N I <sub>2</sub> , 5 mM BTA		10 <sup>-2</sup> N I <sub>2</sub> , 5 mM TTA		10 <sup>-2</sup> N I <sub>2</sub> , 5 mM BTA	
	Succinic Acid		Succinic Acid		Citric Acid	
	0.1 M	0.2 M	0.1 M	0.2M	0.1 M	0.2 M
Removal Rate (nm/min)	33.5	37.4	36.6	47.0	295.1	432.5
STD	12.5	1.9	10.9	6.1	26.6	5.0
SRR (nm/min)	3.2	3.9	2.7	3.1	11.7	18.3

FIG. 15

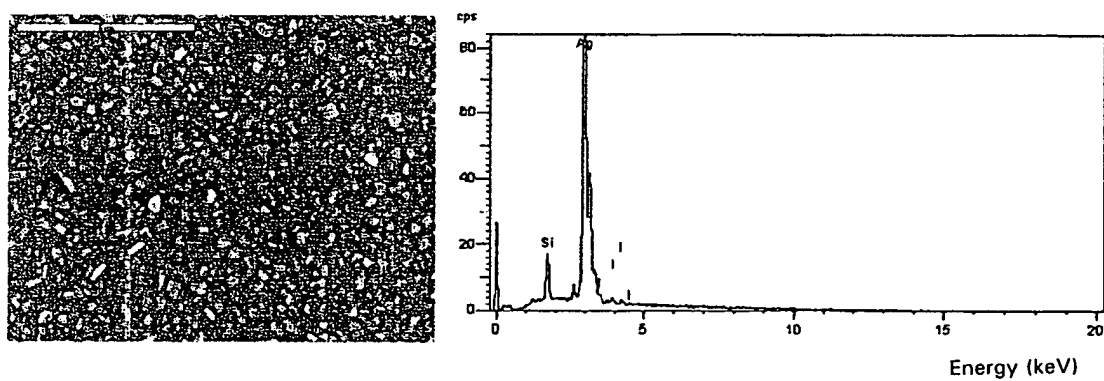
SEM (x10k) pictures and EDS of AgI

Slurry chemistry: 10 mN iodine at pH4



(a)

Slurry Chemistry: 10 mN iodine and 20 mM BTA at pH 4



(b)

FIG. 16